Urban wood/coal cofiring in Pittsburgh area stoker boilerplants

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Introduction

National interest in the combustion of wood and wood/coal mixtures is growing rapidly in response to the world-wide concern for global warming, the U.S. concern for SO2 and NOx emissions, and regional interest in expanding the utilization of forest products and byproducts. The wood/coal cofiring program at the University of Pittsburgh has focused its early work on the use of clean urban waste. A design requirement of the program was that the cofiring be accomplished by providing a wood-coal fuel blend that could be utilized by the boilerhouses as a regular fuel shipment without modification or capital expenditures. Three demonstrations of cofiring wood and coal, up to 12% wood by BTU content, were conducted from 1997 through 1999 at two local boilerplants. The principal wood used in these three demonstrations was broken pallets tub-ground to a mulch-like in its consistency. Combustion was very acceptable, but further development work was required to achieve acceptable feeding characteristics of the mixture through the receiving grill and pit of the boilerplants. In the early spring of 2001 wood/coal cofiring demonstrations were conducted at the Bellefield Boilerplant (BBP) and the Bruceton Research Center Boilerplant (BRC) using construction and demolition (C/D) wood residues processed by improved methods. The prime objective of the University of Pittsburgh's wood/coal cofiring program is the successful introduction in western Pennsylvania of commercial cofiring fuel for stoker boilers. This paper summarizes the results of the demonstrations at BRC and BBP along with observations on the development of a commercial cofiring fuel.

Fuel Development Issues

The Allegheny County Health Department (ACHD) and the Pennsylvania Department of Environmental Protection (PADEP) have been supportive of the use of pallet residue as a cofiring fuel and have readily granted variances for the demonstrations in 1997 and 1999. ACHD has primacy for air quality assurance in the county while PADEP issues permits for urban wood processing centers and has regulates the beneficial use or disposal of coal combustion byproducts. Unfortunately in the Pittsburgh region pallet residue will not be available for processing to a stoker boiler cofuel. C/D wood was used for the wood component of the fuel blend in the 2001 demonstrations at BBP and BRC. Improperly segregated C/D wood has the potential of being contaminated with heavy metals that will cause toxic air emissions and hazardous ashes when combusted. PADEP monitored the collection and processing of the C/D wood, which satisfied ACHD that the wood processors could provide a fuel that was free from hazardous contamination.

In the earlier demonstrations fuel conveyance through the boilerplants was the factor that limited the amount of wood that could be added to the coal in the fuel blends. In these demonstrations an enhanced tub-grinding method was used to prepare a mulch-like wood product and this wood was either mixed on the ground with a front-end loader or layered into a delivery truck. When prepared this way the fuel blend tends to hang-up on the delivery grill and/or segregated in the storage bunkers. For the 2001 demonstrations the wood was prepared by either a further improved tub-grinding method or a three-stage hammermill. These methods produce a more cubic, less stringy wood product. The wood was also mixed with the coal in a Fecon blended to homogeneous consistency.

Fuel Combustion

Wood/coal fuel blends were prepared at wood to coal ratios of 1:4, 1:2 and 2:3 on a volume basis. These blends were delivery to BBP by railcar and BRC by tri-axel truck. Energy Systems Associates (ESA) conducted stack testing for CO2, CO, O2, NOx and SOx at both facilities. The concentration of arsenic, chromium, lead and mercury in stack gases from cofiring demolition wood/coal fuel blends was also determined by ESA.